



Executive Office of
Environmental Affairs



Office of Technical Assistance
www.state.ma.us/ota

Fact Sheet

Reporting Polycyclic Aromatic Compounds

Revised Polycyclic Aromatic Compounds Category for TRI and TURA Reporting:

On October 29, 1999, the Environmental Protection Agency (EPA) added two chemicals to the polycyclic aromatic compounds (PAC) category on the Emergency Planning and Community Right-to-Know Act (EPCRA) Section 313 chemicals list and lowered the Toxics Release Inventory (TRI) reporting threshold to 100 pounds per calendar year for the entire category. Including the two added chemicals (benzo(j,k)fluoranthene and 3-methylcholanthrene), there are now 21 chemicals that comprise the PAC category. Benzo(g,h,i)perylene, another PAC, was added to the EPCRA list of individual chemicals and has a reporting threshold of 10 pounds per calendar year. The Massachusetts Toxics Use Reduction Act, M.G.L. c. 21I (TURA) adopted all of the modified reporting requirements and thresholds.

Classification of Polycyclic Aromatic Compounds:

The EPA classified the PAC category and the individually listed benzo(g,h,i)perylene as Persistent, Bioaccumulative, and Toxic (PBT) chemicals. PBT chemicals are a concern because they are highly toxic, do not break down easily in the environment, and accumulate in living tissues. The reduced threshold of this category for federal and state chemical reporting requirements is part of a nationwide initiative to reduce the risks to human health and the environment from exposure to PBT pollutants.

Most PACs are constituents of fossil fuels. However, other industrial processes are also sources, such as:

- ◆ Hot mix asphalt plants – SIC 2951
- ◆ Asphalt roofing manufacture – SIC 2952
- ◆ Iron foundries – SIC 3321, 3322
- ◆ Primary aluminum producers – SIC 3363, 3365
- ◆ Coke ovens – SIC 3312
- ◆ Pulp mills – SIC 3274
- ◆ Portland cement kilns – SIC 3241
- ◆ Carbon black manufacturing – SIC 2895

Contact the Massachusetts Department of Environmental
Protection to request a TURA Form S reporting package
at (617) 292-5582 or
www.state.ma.us/dep/bwp/dhm/tura/turapubs.htm

Who Must File TURA Form S for Polycyclic Aromatic Compounds?

Under the reporting requirements, a facility must file a Form S for the PAC category or the individually listed benzo(g,h,i)perylene if it meets ALL THREE of the following criteria:

1. Has one of the following SIC codes: 10-14, 20-40, 44-51, 72, 73, 75, or 76; AND
2. Has 10 or more full-time employees or the equivalent of 20,000 hours per year; AND
3. Manufactures (including imports), processes or otherwise uses 100 pounds per year or more of the PAC category or 10 pounds per year or more of benzo(g,h,i)perylene.

Reporting Polycyclic Aromatic Compounds:

The amount of PACs or benzo(g,h,i)perylene that is manufactured, including coincidentally manufactured, processed or otherwise used must be accounted for in determining if a facility meets the reporting threshold.

The fuel uses shown below will meet the reporting threshold for the PAC category:

- No. 6 fuel oil: approx. 5,100 gal/year
- No. 2 fuel oil: approx. 1.4×10^6 gal/year
- No. 4 fuel oil (blend of No. 2 and No. 6 oils):
 - 40% No. 2/ 60% No. 6: approx. 8,400 gal/year
 - 50% No. 2/ 50% No. 6: approx. 10,100 gal/year

Therefore, any facility that combusts a significant amount of fossil fuels (e.g., coal or oil) should determine if they exceed the threshold for both the PAC category and the individually listed benzo(g,h,i)perylene. The PAC category and benzo(g,h,i)perylene thresholds must be determined separately and CAN NOT be reported together. They require a separate TRI Form R and TURA Form S.

For examples of threshold determinations for PACs, refer to the EPA "EPCRA – Section 313: Guidance for Reporting Toxic Chemicals: Polycyclic Aromatic Compounds Category" document. For benzo(g,h,i)perylene, refer to the "EPCRA – Section 313: Guidance for Reporting Toxic Chemicals: Pesticides and Other PBT Chemicals" document. Both are available at:
<http://www.epa.gov/tri/guidance.htm>

Quantifying Polycyclic Aromatic Compounds:

The quantity of PACs and benzo(g,h,i)perylene must be determined separately for each activity – manufactured, processed, or otherwise used. It is required that a facility subject to reporting under TRI and TURA use the best readily available data applicable to their operations. The following sources of data are listed from most accurate to least accurate.

1. Fuel-specific data (e.g., from supplier).
2. Facility-specific emission factors.
3. In the absence of better data, use EPA's default factors provided in the EPA guidance documents.

The EPA's average default values for PAC and benzo(g,h,i)perylene content in common fuels and asphalt, with applicable emissions factors for quantifying byproduct, are shown in Tables 1 and 2, respectively. Example 1 shows how to use these factors to quantify PACs and benzo(g,h,i)perylene for the use of No. 6 fuel oil. Since EPA did not include default values for No. 4 fuel oil in their guidance documents, it is recommended that users of No. 4 oil compute PACs and benzo(g,h,i)perylene content and emission using the procedure shown in Example 2.

Modification of Reporting Procedures:

Reporting procedures for PBTs have been modified and apply to both the PAC category and the individually listed benzo(g,h,i)perylene.

De minimis Exemption Eliminated: The amount of PACs and benzo(g,h,i)perylene contained in the fuel must be quantified to determine whether reporting is required, regardless of how minimal their concentration is in the fuel.

Range Codes Prohibited: An actual amount must be reported for PACs and benzo(g,h,i)perylene. Using range codes for reporting is not an option.

Data Precision: PACs and benzo(g,h,i)perylene must be reported precisely, based on the accuracy of supporting data. The minimum reportable amount is 0.1 pounds. If the amount is less than 0.05 pounds, "0" should be recorded rather than "N/A" (not applicable).

Exclusion from Form A: The use of Form A for reporting PACs and benzo(g,h,i)perylene is prohibited. Form R must be used.

Nuances in Filing Form S:

The thresholds for PBT classified chemicals are the same for state and federal regulations; therefore many Massachusetts companies are required to file both TRI Form R and TURA Form S. Though the reporting procedures for both forms are similar, there are some differences in filing Form S. These are:

- Massachusetts TURA regulations have a broader SIC coverage than the federal EPCRA regulations.
- A facility filing a Form S must report chemical use as well as waste/byproduct generation.

Table 1. EPA average default values for PAC content and emissions factors for common fuels and asphalt.

Source	PAC content	Average emissions factors
No. 2 fuel oil	10.0 ppm (ref. 1)	(a)
No. 6 fuel oil	2,461 ppm (ref. 2)	1.65×10^{-5} lbs/1000 gallons oil combusted (ref 5) ^d
Coal-fired boiler, controlled	(a)	1.12×10^{-6} lbs/ton coal combusted (ref. 5) ^e
Natural gas-fired boiler	(a)	8.69×10^{-7} lbs/MMCF natural gas combusted (ref. 6) ^b
Natural gas-fired boiler	(a)	4.37×10^{-7} lbs/MMCF natural gas combusted (ref. 6) ^c
Gasoline	17.0 ppm (ref. 3)	(a)
Wood waste combustion, with particulate matter controls	(a)	5.15×10^{-5} lbs/ton wood waste combusted (ref. 5) ^f
Paving Asphalt	178 ppm (ref. 4)	(a)

- (a) The EPA guidance does not contain this data. This should not be interpreted to mean that PACs are not present; you are required to use the best readily available information to determine PACs usage.
- (b) Source Classification Codes (SCC) Number 1-02-006-01, 02, 03; uncontrolled; based on 10 units tested: 2 firetube, 1 scotch, 7 watertube, rated capacity range: 7.2-178 MMBtu/hr.
- (c) SCC Number 1-03-006-01, 02; uncontrolled; based on 5 packaged watertube boilers tested, rated capacity range: 17.4-126 MMBtu/hr. **EPA recommends that facilities choose between this value and the one above by matching the type of boiler.**
- (d) Section 1.3, Fuel Oil Combustion, Table 1.3-9; SCC 1-01-004-01/04
- (e) Section 1.1, Supplement E, Table 1.1-13; factors developed from emissions data from six sites firing bituminous coal, four sites firing subbituminous coal, and from one site firing lignite. Factors apply to boilers using both wet limestone scrubbers or spray dryers with an ESP or fabric filter. The factors also apply to boilers using only an ESP or fabric filter. Emission factor should be applied to coal feed, as fired, and are lb of pollutant per ton of coal combusted.
- (f) Section 1.6, Supplement E, Table 1.6-4. Units are lb of pollutant/ton of wood waste burned. Emission factors based on wet, as fired wood waste with average properties of 50 weight % moisture and 4500 Btu/lb heating value. PM controls include fabric filter, multi-cyclones, ESP, and wet scrubbers.

Table 2. EPA average default values for Benzo(g,h,i)perylene content and emissions factors for common fuels and asphalt.

Source	Benzo(g,h,i)perylene content	Average emissions factors
No. 2 fuel oil	0.05 ppm (ref. 7)	(a)
No. 6 fuel oil	26.5 ppm (ref. 2)	2.26×10^{-6} lbs/1000 gal oil combusted (ref. 5)
Coal-fired boiler, controlled	(a)	2.70×10^{-8} lbs/ton coal burned (ref. 5)
Gasoline	2.55 ppm (ref. 3)	(a)
Wood waste combustion (with PM controls, 50% moisture basis, 4500 Btu/lb higher heating value)	(a)	1.41×10^{-6} lbs/ton wood waste burned (ref. 5)
Paving Asphalt	1.2 ppm (ref. 4)	(a)
(a) The EPA guidance does not contain this data. This should not be interpreted to mean that benzo(g,h,i)perylene is not present; you are required to use the best readily available information to determine benzo(g,h,i)perylene usage.		

Example 1:

A Massachusetts facility has an SIC code covered by both TURA and TRI. It has more than 10 full-time employees and burns 100,000 gallons of No. 6 fuel oil annually. The density of No. 6 fuel oil is approximately 8 lbs/gallon. Using the factors from the EPA guidance documents, PACs and benzo(g,h,i)perylene would be quantified as follows:

PACs:

$(100,000 \text{ gallons}) \times (8 \text{ lbs oil/gallon}) \times (2461 \text{ lbs PAC}/1 \times 10^6 \text{ lbs oil}) = 1968.8 \text{ lbs/yr PACs otherwise used.}$

$(100,000 \text{ gallons}) \times (1.65 \times 10^{-5} \text{ lbs/1000 gallons oil}) = 0.00165 \text{ lbs/yr PACs coincidentally manufactured.}$

Benzo(g,h,i)perylene:

$(100,000 \text{ gallons}) \times (8 \text{ lbs oil/gallon}) \times (26.5 \text{ lbs benzo(g,h,i)perylene}/1 \times 10^6 \text{ lbs oil}) = 21.2 \text{ lbs/yr benzo(g,h,i)perylene otherwise used.}$

$(100,000 \text{ gallons}) \times (2.26 \times 10^{-6} \text{ lbs benzo(g,h,i)perylene/1000 gallons oil}) = 2.26 \times 10^{-4} \text{ lbs/yr benzo(g,h,i)perylene coincidentally manufactured.}$

The facility exceeded the reporting thresholds for both the PAC category and benzo(g,h,i)perylene. Therefore, Form R and Form S must be submitted for both the PAC category and benzo(g,h,i)perylene.

Section 1.2 of the Form S for the PAC category would be completed as follows:

1.2a Manufactured: 0 1.2c Otherwise Used: 1969 1.2e Shipped in or as Product: 0
 1.2b Processed: 0 1.2d Generated as Byproduct: 0

Section 1.2 of the Form S for the individually listed benzo(g,h,i)perylene would be completed as follows:

1.2a Manufactured: 0 1.2c Otherwise Used: 21 1.2e Shipped in or as Product: 0
 1.2b Processed: 0 1.2d Generated as Byproduct: 0

OTA Assistance Services

The Office of Technical Assistance (OTA) provides one-on-one technical assistance on pollution prevention (P2), toxics use reduction (TUR) and compliance – as well as guidance in the form of workshops, case studies, manuals and other materials. OTA helps toxics users in Massachusetts to identify TUR/P2 opportunities within their operations and initiate planning efforts. Contact OTA at:

*251 Causeway Street, Suite 900, Boston, MA 02114
 Phone: (617) 626-1060 or on-line at www.state.ma.us/ota*

Example 2 – Quantifying PACs and Benzo(g,h,i)perylene for the combustion of No. 4 fuel oil:

No. 4 fuel oil is a blend of No. 2 oil and No. 6 oil. Since the proportions of Nos. 2 and 6 oils can vary, contact your oil supplier for the composition of the No. 4 oil you are using (if they don't have it, assume a 50/50 blend). With this information, the quantities of PACs and benzo(g,h,i)perylene otherwise used and coincidentally manufactured can be calculated using the following formulas and the EPA default values:

[X] = fraction of No. 2 oil density No. 2 oil = 7.1 lbs/gal
 [Y] = fraction of No. 6 oil density No. 6 oil = 8.0 lbs/gal

For No. 4 oil that is a 40/60 blend: [X] = 0.4, [Y] = 0.6; for a 50/50 blend: [X] = 0.5, [Y] = 0.5

Otherwise used:PACs:

$$\text{lbs/yr PACs} = [(\text{gal/yr No. 4}) \times ([X] \text{ gal No. 2/gal No. 4}) \times (7.1 \text{ lbs No. 2/gal No. 2}) \times (10 \text{ lbs PAC}/1 \times 10^6 \text{ lbs No. 2})] + [(\text{gal/yr No. 4}) \times ([Y] \text{ gal No. 6/gal No. 4}) \times (8 \text{ lbs No. 6/gal No. 6}) \times (2,461 \text{ lbs PAC}/1 \times 10^6 \text{ lbs No. 6})]$$

Thus, for the combustion of 100,000 gal/yr of No. 4 oil that is a 40/60 blend, the amount of PACs otherwise used is:

$$\text{lbs/yr PACs} = [(100,000)(0.4)(7.1)(10/1 \times 10^6)] + [(100,000)(0.6)(8)(2,461/1 \times 10^6)] = \underline{1,184.1 \text{ lbs/yr PACs}}$$

Benzo(g,h,i)perylene:

$$\text{lbs/yr BP} = [(\text{gal/yr No. 4}) \times ([X] \text{ gal No. 2/gal No. 4}) \times (7.1 \text{ lbs No. 2/gal No. 2}) \times (0.05 \text{ lbs BP}/1 \times 10^6 \text{ lbs No. 2})] + [(\text{gal/yr No. 4}) \times ([Y] \text{ gal No. 6/gal No. 4}) \times (8 \text{ lbs No. 6/gal No. 6}) \times (26.5 \text{ lbs BP}/1 \times 10^6 \text{ lbs No. 6})]$$

For 100,000 gal/yr of No. 4 oil that is a 40/60 blend, the amount of BP otherwise used is:

$$\text{lbs/yr BP} = [(100,000)(0.4)(7.1)(0.05/1 \times 10^6)] + [(100,000)(0.6)(8)(26.5/1 \times 10^6)] = \underline{12.73 \text{ lbs/yr BP}}$$

Coincidentally manufactured:

Since EPA does not provide PACs and benzo(g,h,i)perylene emission factors for No. 2 oil, it is assumed that these factors are the same as for No. 6 oil, meaning that the estimated amounts of coincidentally manufactured PACs and benzo(g,h,i)perylene for No. 4 oil will be the same as for No. 6 oil (conservative assumption).

$$\text{PACs: lbs/yr PACs} = (\text{gal/yr No. 4}) \times (1.65 \times 10^{-5} \text{ lbs PAC}/1000 \text{ gal oil})$$

Thus, for the combustion of 100,000 gal/yr of No. 4 oil, *regardless of the proportions of Nos. 2 and 6 oils*, the amount of PACs coincidentally manufactured is:

$$\text{lbs/yr PACs} = (100,000 \text{ gal/yr}) \times (1.65 \times 10^{-5} \text{ lbs PAC}/1000 \text{ gal oil}) = \underline{0.00165 \text{ lbs/yr PACs}}$$

$$\text{Benzo(g,h,i)perylene: lbs/yr BP} = (\text{gal/yr No. 4}) \times (2.26 \times 10^{-6} \text{ lbs BP}/1000 \text{ gal oil})$$

$$\text{lbs/yr BP} = (100,000 \text{ gal/yr}) \times (2.26 \times 10^{-6} \text{ lbs BP}/1000 \text{ gal oil}) = \underline{0.000226 \text{ lbs/yr BP}}$$

The reporting thresholds for both the PAC category and benzo(g,h,i)perylene were both exceeded. Therefore, Form R and Form S must be submitted for both the PAC category and benzo(g,h,i)perylene.

References

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